

Education Module – Chuck Aid

Title:

How Green is Your Home? - Assessing Your Home Using Criteria from the U.S. Green Building Council

Author:

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Grade level/ Subject:

5th – 8th grade / Science and/or Math

National Science Education Standards (National Academy of Sciences):

Content Standard A – Science as Inquiry: As a result of activities in grades 5-8, all students should develop abilities necessary to do scientific inquiry and understandings about scientific inquiry.

- Identify questions that can be answered through scientific investigations.
- Design and conduct a scientific investigation.
- Use appropriate tools and techniques to gather, analyze, and interpret data.
- Develop descriptions, explanations, predictions, and models using evidence.
- Think critically and logically to make the relationships between evidence and explanations.
- Recognize and analyze alternative explanations and predictions.
- Communicate scientific procedures and explanations.
- Use mathematics in all aspects of scientific inquiry.

Content Standard B – Physical Science: As a result of their activities in grades 5-8, all students should develop an understanding of properties and changes of properties in matter, motions and forces, and transfer of energy.

Content Standard C – Life Science: As a result of their activities in grades 5-8, all students should develop understanding of structure and function in living systems, reproduction and heredity, regulation and behavior, populations and ecosystems, and diversity and adaptations of organisms.

Content Standard D - Earth and Space Science: As a result of their activities in grades 5-8, all students should develop an understanding of **structure of the earth system**, **earth's history**, and **earth in the solar system**.

Content Standard E - Science and Technology: As a result of activities in grades 5-8, all students should develop **abilities of technological design** and **understandings about science and technology**.

Content Standard F- Science in Personal and Social Perspectives: As a result of activities in grades 5-8, all students should develop understanding of **personal health**, **populations, resources, and environments**, **natural hazards**, **risks and benefits**, **science and technology in society**.

Content Standard G - History and Nature of Science: As a result of activities in grades 5-8, all students should develop understanding of **science as a human endeavor**, **nature of science**, **history of science**.

Colorado Model Content Standards for Science

1. Students understand the **processes of scientific investigation** and design, conduct, communicate about, and evaluate such investigations.
2. Physical Science: Students know and understand common properties, forms, and changes in matter and energy
 - 2.1 Students know that **matter has characteristic properties**, which are related to its composition and structure (e.g. **electrical charge, temperature, density**)
 - 2.2 Students know that **energy appears in different forms** (e.g. they can determine **electrical charge, current, voltage**), and **energy can be transferred and be transformed** (e.g. they can describe **qualitative and quantitative relationships**, using **data, observations and graphs**, associated with energy transfer or transformation).
 - 2.3 Students understand that interactions can produce changes in a system, although the total quantities of matter and energy remain unchanged.
3. Life Science
4. Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space.

- 4.1 Students know and understand the composition of Earth, its history, and the natural processes that shape it.
- 4.2 Students know and understand the general characteristics of the atmosphere and **fundamental processes of weather**.
- 4.3 Students know major sources of water, its uses, importance, and cyclic patterns of movement through the environment.
- 4.4 Students know the structure of the solar system, composition and **interaction of objects in the universe**, and how space is explored.
- 5. Students know and understand **interrelationships among science, technology, and human activity** and how they can affect the world.
- 6. Students understand that **science involves a particular way of knowing** and understand common connections among scientific disciplines.

Overview:

Students will be given a list of criteria for assessing the degree to which their home and/or school may be ranked as being green. These criteria evaluate environmental performance from a whole building perspective. Credits are earned for satisfying each criterion. Different levels of Green Building Certification will be awarded based on the total credits earned.

Determinations for some criteria will require that students record the energy use in their home and/or school by monitoring electric and gas meters. They will have to create maps and floor plans, locating items on them, as well as determining percentages of areas. They will have to collect data from a variety of resources (e.g. personal research, web sites, library, telephone calls, utility bills, product labels, parents, etc.).

Purpose:

The ideal green building would be designed, constructed, maintained, and used in such a way that no natural resources would be depleted or permanently damaged at any time in the development or life of the building. Certainly, no building can be that perfectly efficient, however attempts can be made to approximate that perfection. To do so a building must embody a design intent on balancing environmental responsiveness, resource efficiency, and cultural and community sensitivity. It must meet the needs of current occupants while being mindful of the needs of future generations.

Buildings in the U.S. consume more than 30% of our total energy and 60% of our electricity. They consume 5 billion gallons of potable water per day – just to flush toilets. Land for buildings is, for the most part, being converted from natural habitats and agriculture. These are just a few examples of the environmental impacts associated with the construction and operation of buildings.

Green building practices can reduce and even reverse these negative environmental impacts. Added benefits can also include reduced operating expenses and a healthier indoor environment.

The purpose of this lesson is to introduce students to methods and rationales:

- for maintaining sustainable sites surrounding buildings.
- for using water in buildings more efficiently.
- for reducing energy demands and energy related pollution.
- for recycling materials and resources.
- for improving indoor environmental quality.
- for encouraging their own innovative approaches to increased energy efficiency and sustainability.

Introduction: As the most energy-intensive society on the planet, we know little about where the energy we use comes from, where it actually gets used, or how we might potentially use it more efficiently. This investigation will have students assess how much energy is being used within their homes and/or school. They will be able to see areas in which energy is currently being conserved, and where opportunities exist for better conservation efforts

SCORECARD for LEED EB

For tracking point scores at the beginning, middle and completion of a building project.

16 Points – Sustainable Sites

☐ Prerequisite 1: Erosion and Sedimentation Control

☐ Credit 1: Site Selection

☐ Credit 2: Urban Redevelopment (2 points)

Credit 3: Brown Field Redevelopment [Not Available for LEED EB]

☐ Credit 4.1: Environmentally Preferable Transportation – Public Transportation Access

☐ Credit 4.2: Environmentally Preferable Transportation – Bicycle Friendly

☐ Credit 4.3: Environmentally Preferable Transportation – Alternative-Fuel Refueling Stations

☐ Credit 4.4: Environmentally Preferable Transportation – Parking Capacity

☐ Credit 5.1: Reduced Site Disturbance – Vegetated Ground Cover

☐ Credit 5.2: Reduced Site Disturbance – Native or Adapted Vegetation

☐ Credit 6.1: Stormwater Management – 25% Stormwater Runoff Reduction

☐ Credit 6.2: Stormwater Management – Treatment

☐ Credit 7.1: Reduced Heat Island Effect – Non-Roof Surfaces

☐ Credit 7.2: Reduced Heat Island Effect – Roof Surfaces

☐ Credit 8: Light Pollution Reduction

☐ Credit 9.1: Green Site and Building Exterior Management – Overall Management Plan

☐ Credit 9.2: Green Site and Building Exterior Management - Chemicals

5 Points – Water Efficiency

- ☐ Prerequisite 1: Minimum Water Efficiency
- ☐ Prerequisite 2: Discharge Water Compliance
- ☐ Credit 1.1: Water Efficient Landscaping – 50% Reduction
- ☐ Credit 1.2: Water Efficient Landscaping – No Potable Water Use or No Irrigation
- ☐ Credit 2: Innovative Wastewater Technologies
- ☐ Credit 3.1: Water Use Reduction – 10% Reduction
- ☐ Credit 3.2: Water Use Reduction – 20% Reduction

22 Points – Energy and Atmosphere

- ☐ Prerequisite 1: Comprehensive Building Commissioning/Retro Commissioning
- ☐ Prerequisite 2: Minimum Energy Performance
- ☐ Prerequisite 3: Ozone Protection
- ☐ Credit 1.1: Optimize Energy Performance (2 points)
- ☐ Credit 1.2: Optimize Energy Performance (2 points)
- ☐ Credit 1.3: Optimize Energy Performance (2 points)
- ☐ Credit 1.4: Optimize Energy Performance (2 points)
- ☐ Credit 1.5: Optimize Energy Performance (2 points)
- ☐ Credit 2.1: Renewable Energy
- ☐ Credit 2.2: Renewable Energy
- ☐ Credit 2.3: Renewable Energy
- ☐ Credit 3.1: Continuous Commissioning and Maintenance – Continuous Commissioning
- ☐ Credit 3.2: Continuous Commissioning and Maintenance – Maintenance Contracts
- ☐ Credit 3.3: Continuous Commissioning and Maintenance – Comprehensive Preventative Maintenance
- ☐ Credit 4: Additional Ozone Protection
- ☐ Credit 5.1: Measurement and Verification – M & V for Equipment Groupings
- ☐ Credit 5.2: Measurement and Verification – M & V for Equipment Groupings
- ☐ Credit 5.3: Measurement and Verification – M & V for Equipment Groupings
- ☐ Credit 5.4: Measurement and Verification – Emission Reduction Reporting
- ☐ Credit 6: Green Power

SCORECARD for LEED EB (cont.)**10 Points – Materials and Resources**

- ☐ Prerequisite 1: Waste Management
- ☐ Credit 1: Continued Existing Building Use
- ☐ Credit 2: Construction Waste Management
- ☐ Credit 3: Resource Reuse
- ☐ Credit 4: Recycled Content
- ☐ Credit 5: Local/Regional Materials
- ☐ Credit 6: Rapidly Renewable Materials
- ☐ Credit 7: Certified Wood
- ☐ Credit 8.1: Occupant Recycling – 30% total waste stream volume
- ☐ Credit 8.2: Occupant Recycling – 40 % total waste stream volume
- ☐ Credit 8.3: Occupant Recycling – 50% total waste stream volume

18 Points – Indoor Environmental Quality

- ☐ Prerequisite 1: Minimum IAQ Performance
- ☐ Prerequisite 2: Environmental Tobacco Smoke (ETS) Control
- ☐ Prerequisite 3: Asbestos Removal or Encapsulation
- ☐ Credit 1: Carbon Dioxide (CO₂) Monitoring
- ☐ Credit 2: Increase Ventilation Effectiveness
- ☐ Credit 3: Construction IAQ Management Plan

Credit 4: Low-Emitting Materials [Not Applicable to LEED EB]

- ☐ ☐ ☐ Credit 5.1: Green Housekeeping – “Doormat”
- ☐ ☐ ☐ Credit 5.2: Green Housekeeping – Isolation of Water and Chemical Mixing
- ☐ ☐ ☐ Credit 5.3: Green Housekeeping – Isolation of copying/printing/fax
- ☐ ☐ ☐ Credit 5.4: Green Housekeeping – Low impact housekeeping policy
- ☐ ☐ ☐ Credit 5.5: Green Housekeeping – Use of Recycled Products
- ☐ ☐ ☐ Credit 5.6: Green Housekeeping – Pest Management
- ☐ ☐ ☐ Credit 5.7: Green Housekeeping – Outdoor Chemical Storage
- ☐ ☐ ☐ Credit 6.1: Controllability of Systems – 45% of occupied areas
- ☐ ☐ ☐ Credit 6.2: Controllability of Systems – 90% of occupied areas
- ☐ ☐ ☐ Credit 7.1: Thermal Comfort - Compliance with ASHRAE 55-1992
- ☐ ☐ ☐ Credit 7.2: Thermal Comfort – Permanent Monitoring System
- ☐ ☐ ☐ Credit 8.1: Daylighting and Views – Views from 40% of total area
- ☐ ☐ ☐ Credit 8.2: Daylighting and Views – Views from 80% of total area
- ☐ ☐ ☐ Credit 8.3: Daylighting and Views - Daylighting
- ☐ ☐ ☐ Credit 9: Contemporary IAQ Practice

5 Additional Points – Innovation and Accredited Professional

- ☐ ☐ ☐ Credit 1.1: LEED EB Innovation Credits
- ☐ ☐ ☐ Credit 1.2: LEED EB Innovation Credits
- ☐ ☐ ☐ Credit 1.3: LEED EB Innovation Credits
- ☐ ☐ ☐ Credit 1.4: LEED EB Innovation Credits
- ☐ ☐ ☐ Credit 2: LEED Accredited LEED EB Professional

76 TOTAL POINTS AVAILABLE [To Date]

LEED Certified for Existing Buildings = 28 – 35 points (40% of total)
LEED Certified Silver for Existing Buildings = 36 – 42 points (50% of total)
LEED Certified Gold for Existing Buildings = 43 – 56 points (60% of total)
LEED Certified Platinum for Existing Buildings = 57+ points (80% of total)